Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Simulation of current-filament dynamics and relaxation in the Pegasus ST[1] J.B. O'BRYAN, C.R. SOVINEC, University of Wisconsin–Madison — The dynamics of magnetic relaxation of during non-inductive startup in the Pegasus spherical tokamak are investigated with nonlinear MHD-based numerical computation. A new phenomenology, evident from our modeling, is the attraction and reconnection of adjacent passes of the helical filament, releasing axisymmetric rings of current [O'Bryan, Phys. Plas. 19, 080701 (2012)]. Accumulation of poloidal flux over multiple relaxation events leads to toroidal configurations with hollow average $J_{||}$ profiles. Similar to experimental results, the magnetic fluctuation during helicity injection is approximately 5% of the toroidal field with significant activity in the 10-20 kHz range. The inclusion of two-fluid effects in Ohm's law produces qualitatively similar plasma evolution. Temperature and current profiles broaden and closed flux surfaces form rapidly upon cessation of the simulated current drive, leaving a tokamak-like discharge suitable for transition to other forms of current drive. Investigation of time-dependent evolution of externally driven poloidal flux is underway.

[1]Work supported by the US Dept. of Energy

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Date submitted: 12 Jul 2013 Electronic form version 1.4